tion of a laboratory in which advanced students were to be trained in the methods of scientific research, would be very far from holding a sinecure office, and would be rendering the highest, as well as the most direct, service to scientific education.

"We have no doubt that for a professor the duty of teaching is indispensable, but we agree with the witnesses whom we have examined that original research is a no less important part of his functions. The object of an university is to promote and to maintain learning and science, and scientific teaching of the highest kind can only be successfully carried on by persons who are themselves engaged in original research. If once a teacher ceases to be a learner it is difficult for him to maintain any freshness of interest in the subject which he has to teach; and nothing is so likely to awaken the love of scientific inquiry in the mind of the student as the example of a teacher who shows his value for knowledge by making the advancement of it the principal business of his life.

"It has been, to a certain extent, a complaint against the School of Natural Science in Oxford that hitherto it has produced but very few original workers. The complaint (if well founded) may, perhaps, be accounted for by the circumstance that the school has not been long in existence; but there can be no question that it is of the utmost importance to impress upon teachers and learners alike that one, and perhaps the chief criterion of success in the teaching of Science is its leading to new discoveries. To promote this end the Universities probably can do nothing more useful than to increase the number of persons employed, under whatever name, in the teaching of Science, taking care at the same time that while such duties are assigned to them as may prevent their offices from being sinecures, they shall be left with time and energy enough to carry on original work. We consider this to be a point of great importance, and we should regret to see any scientific office whatever established in either of the Universities without its being understood that it is expected from the holder that he shall do what is within his power, not only for the diffusion, but also for the increase of scientific knowledge.

"It has been stated in some parts of the evidence which we have taken, that the duties of lecturing and teaching which are required from the professors are such as seriously to interfere with their leisure for original investigation, and a wish has therefore been expressed that the provisions of the Professorial Statutes as to the number of lectures to be given should be relaxed. We cannot concur with this suggestion. In estimating the amount of teaching and lecturing which can properly be required from a professor, we do not forget that he is expected to keep himself well acquainted with all the latest advances in some very wide department of knowledge, a task which, at the present rate of scientific productiveness, is no light one. But, on the other hand, we cannot leave out of sight that the University duties of a professor last for only six months, and that he has thus the invaluable privilege of being master of his own time for fully one half of the year. It is, therefore, only reasonable that during the University Terms he should devote a fair proportion of his time to the work of teaching. And we feel it to be our duty to say that, in recommending, as we have done, the foundation of a considerable number of new Scientific Professorships, our intention is that duties of a very substantial kind should be attached to each of these offices, with a view to the establishment of an efficient and complete course of instruction."

From the limited scope of the functions of the various existing administrative bodies, as well as from the constitution of one of them, the Commissioners consider that they cannot be regarded as representing, in any adequate manner, the Scientific Faculty of the University. They then add, "We are of opinion that the best mode of providing for this important object would be to replace them by a Single Administrative Body, representing every department of Science, and having wider but still definite powers entrusted to it. Without attaching any importance to the name, we shall, for the purposes of the present Report, designate this proposed administrative body as the University Council of Science.'

"The duties of the Council would, we conceive, be twofold—educational and financial."

(*To be continued.*)

HARMONIC ECHOES

ACCORDING to Dr. Brewer[*] "The harmonic echo repeats in a different tone or key the direct sound. The harmonic is generally either the third, fifth, or tenth of the tonic.... On the river Nahe, near Bergen, and not far from Coblentz, is an echo thus described by Barthius:—It makes seventeen repetitions at unequal intervals. Sometimes the echo seems to approach the listener, sometimes to be retreating from him; sometimes it is very distinct, at others extremely feeble; at one time it is heard at the right, and the next at the left; now in unison with the direct sound, and presently a third, fifth, or tenth of the fundamental. Occasionally it seems to combine two or more voices in harmony, but more frequently it resembles the voice of a single mimic.

"At Paisley, in Scotland, there is a somewhat similar echo in the burying-place of Lord Paisley, Marquis of Abercorn. Musical notes rise softly, swell till the several echoes have reverberated the sound either in unison or harmony, and then die away in gentle cadence.

"At the Lake of Killarney, in Ireland, is a very celebrated harmonic echo, which renders an excellent *second* to any simple air played on a bugle.[†]

"There was formerly, according to the authority of Dr. Birch, an harmonic echo no less remarkable, seventeen miles above Glasgow, near a mansion called Rosneath. If a trumpeter played eight or ten notes, the echo would repeat them correctly a third lower. After a short silence another repetition was heard, still lower than the former; and after a similar pause the same notes were repeated a third time, in a lower key and feebler tone, but nevertheless, with the same undeviating fidelity. This echo no longer exists."

It is difficult to believe that these descriptions are accurate, but that they have a basis of truth there can be little doubt. My attention was first drawn to the subject

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[*] "Brewer on Sound and its Phenomena." (1864.) P. 305.

[†] This must be a near connection of the equally celebrated Irish echo, which in reply to "How do you do?" answers, "Very well, thank you."—R. Or of that celebrated echo at Shoreditch Station, illustrated by poor Leech in *Punch*, where, to the old gentleman's call of "Porter," is replied "Don't you wish you may get him."—ED.

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by an echo at Bedgebury Park, the country residence of Mr. Beresford Hope. The sound of a woman's voice was returned from a plantation of firs, situated across a valley, with the pitch *raised an octave*. The phenomenon was unmistakeable, although the original sound required to be loud and rather high. With a man's voice we did not succeed in obtaining the effect.

At the time I had no idea that such an alteration of pitch had ever been observed, or was possible; but it soon occurred to me that the explanation was similar to that which I had given of the blue of the sky a year or two previously (Philos. Mag., Feb. 1871). Strange to say, at the very time of the observation I had in my portfolio a mathematical investigation* of the problem of the disturbance of the waves of sound by obstacles which are small in all their dimensions relatively to the length of the sound waves. In such a case (precisely as in the parallel problem for sight) it appears that the reflecting, or rather diverting, power of the obstacle varies inversely as the fourth power of the wave-length. When a composite note, such as that proceeding from the human throat, impinges on the obstacle, its components are diverted in very different proportions. A group of small obstacles will return the first harmonic, or octave, sixteen times more powerfully than the fundamental. After this, it is not hard to understand how a wood, which may be considered to be made up of a great number of obstacles, many of which, in two or three of their dimensions, are small in comparison with the wave-length, returns a sound which appears to be raised an octave.

The increased reflection is, of course, at the expense of the direct sound. If we conceive a group of small obtacles to act on a train of plane waves of sound, the effect will be a *diffused* echo, which may be heard on all sides, appearing to proceed from the group, and the direct waves which maintain their direction. If the original sound be composite, the diffused echo contains the higher elements in excessive proportion, and for the same reason the direct wave, being shorn of these higher elements, will appear duller than the original sound. It is well known that pure tones are liable to be estimated an octave too low, and thus it may be possible that a note in losing its harmonies may appear to fall an octave.

What is here called the direct sound may itself be converted into an echo by *regular* reflection. For example, if a plane wall were covered with small projections, there would be a diffused echo, due to the projections in which the higher elements preponderated, and an ordinary echo, obeying the law of reflection, in which the wave elements would preponderate.

I shall be much obliged if any one under whose observations echoes of this description may happen to fall, would communicate particulars of them to NATURE.

RAYLEIGH

LEITH-ADAMS' "FIELD AND FOREST RAMBLES"

Field and Forest Rambles. By A. Leith-Adams, F.R.S. (Henry S. King & Co.)

ONCE, on our expressing surprise to a friend at the fact of his having forsaken his usual line of study for another of a very different character, he remarked, "Well, you see it does not matter much what I take up, for whatever it may be, I am sure to make some discovery of value." The reply was sufficient to enable anyone to form an idea of the results that might be expected. He was an assiduous and earnest worker, but there was a certain deficiency in the quality of all he produced.

Mr. Leith-Adams is an assiduous and earnest worker; his opportunities in connection with his military avocations, have been considerable, and he has used them well. He has already given us the results of his experience in India and elsewhere in his "Wanderings of a Naturalist in India," as well as in the "Natural History and Archæology of the Nile Valley and Maltese Islands," and in the work before us he takes us to New Brunswick, vividly portraying the beauties of its short summers and the discomforts of its dreary winters. An intense love for natural history has led him to make careful and prolonged observations as to the habits of most of the animals inhabiting the province of which he treats, together with the dates and direction of migration of the numerous migratory birds which are there met with. He has also paid considerable attention to the fish, and the geology of the district.

Our author, in endeavouring to obtain an accurate account of the past history of the native Indians of New Brunswick, found the task of more than ordinary difficulty, "inasmuch as, even apart from their persistent indifference to treat on any subject connected with their past history or present condition, there would seem to be an absolute incapacity to comprehend the meaning of such inquisitiveness on the part of the interrogator." Drink is the ruination of the remnant of this doomed race, a race so little advanced in the scale of humanity, that when it has disappeared, there will not be left a trace even of written or monumental record; "indeed, were it not for implements of the chase picked up occasionally, we should have few other data to establish the existence of the human inhabitants of the region, previous to the arrival of the first European travellers." The European colonist, as long as he is the possessor of the *mens sanus in corpore sano*, however, stands a better chance of surviving; nevertheless leprosy produces painful ravages among the original French settlers, on the north-east frontier of the province.

No explanation is attempted of the fact quoted from Dr. Gilpin, that many of the wild animals, as the bear, racoon, and beaver, which were driven from their haunts on the clearing of the forests, are again returning to the same districts, "to cultivated fields instead of primitive forests, to corn and maize, instead of wild fruits and berries." We cannot help thinking that this does not say much for the present assiduity of the farmers.

Albinism and Melanism, the tendency for certain individuals of a species to be white or black, is one of Mr. Adams' favourite subjects, and he gives it as his opinion that the reason why they in the wild state do not continue to propagate their peculiarity is because "the very decided difference as regards outward appearance would be sufficient to forbid intercourse between them and the typical individuals."

There is a want of point in many of the author's attempts at explanation of the various phenomena which.

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* Since communicated in an amplified form to the Mathematical Society.

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